

# Cooking Cost Comparison using LPG, Rice Cooker, Induction and Infrared Cooker

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## 1. Introduction

According to the annual Foreign Trade Statistic of the Department of Customs, trade deficit has increased by 13.55 per cent to NRs. 1,321.42 billion in the fiscal year 2018/19 compared to previous fiscal year 2017/18. The majority of the trade deficit is mainly due to import of petroleum products including LPG. In fiscal year 2017/18, Nepal has imported 370,560 MT of LPG (about 72,000 LPG cylinder per day) which is mainly used for cooking purpose<sup>1</sup>.

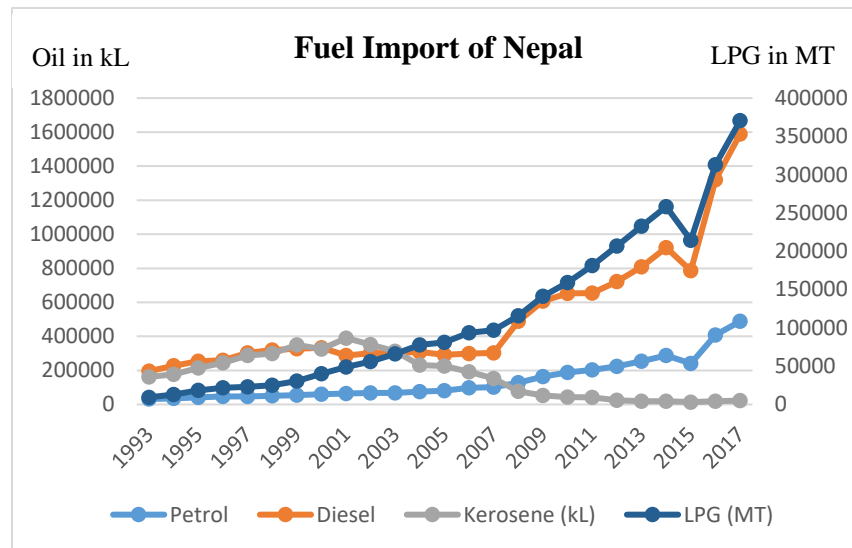


Figure 1. Annual Fossil Fuel Import Trends of Nepal<sup>2</sup>

If Nepal continues to depend on imported energy sources as shown in figure1, it is going to be very difficult to reduce ever increasing trade deficit of Nepal. Country needs the new energy policy which will be helpful to discourage the use of imported fuel by promoting the clean energy sources available within the country. It is said that, if internal consumption is not increased soon, Nepal Electricity Authority (NEA) will have surplus electricity generation in coming years. To increase the internal consumption, switching of cooking fuel from LPG to electricity could be the easiest and fastest way which also saves billions of Nepalese Rupees (actually hard earned convertible

<sup>1</sup> Economic Survey of Nepal, 2076, Ministry of Finance, GoN

<sup>2</sup> <http://noc.org.np/import>, Dec, 2019

currency of Nepal). So, it is high time to promote the use of new cookers powered by electricity in Nepalese kitchen to save energy, save cooking time, reduce indoor pollution and above all the cost of cooking.

**2. Parameters that need to be considered while finding the cost of cooking C(t)**

The exact cooking cost C(t) depends upon the parameters related to location, ambient conditions, energy source and types of pot used in cooking represented by functions like alpha, beta, gamma and theta as given below.

$$C(t) = f(\alpha, \beta, \gamma, \theta) \text{-----(i)}$$

Where,

$\alpha = f(\text{coordinates of location, altitude})$

$\beta = f(\text{ambient temperature, humidity, air pressure, air flow})$

$\gamma = f(\text{types of energy used and its thermal efficiency})$

$\theta = f(\text{types of cooking pot})$

**3. Experiment**

Recently we have conducted a simple experiment, at Center for Energy Studies (CES), Institute of Engineering, Tribhuvan University, on cooking of 0.5 kg of rice using LPG, ordinary coil heater, rice cooker, induction and infrared (two burner e-Chulo and one burner) using induction friendly pressure cooker under similar ambient condition. Though the experiment was conducted with limited resources, it has revealed that cooking with induction cooker saves energy and time as well as cost by 42% as compared to LPG. Infrared based cooking performance is comparable with induction cooker. Because of visible smokeless fire and with easy controls infrared based e-Chulo with two burner seems more acceptable to most Nepalese as shown in Table 1.



Figure 2: Experimental setup for the rice cooking using different devices at CES/IOE, Pulchowk

#### 4. Findings

As figure 3 clearly indicates that shifting of cooking fuel from LPG to electricity in Nepalese kitchen is a positive step and it can save billions of rupees being spent in purchasing LPG from India. In addition to this experiment, we propose to conduct more detail experiments on cooking using different fuels, different cook stoves and cooking a complete set of Nepalese usual food. This experiment will be helpful to answer many questions raised by general public regarding the real cooking price including the cost of different cook stoves in **three geographic regions of Nepal**. In addition, the proposed work will be helpful to encourage people to switch on cooking fuel from LPG to electric.

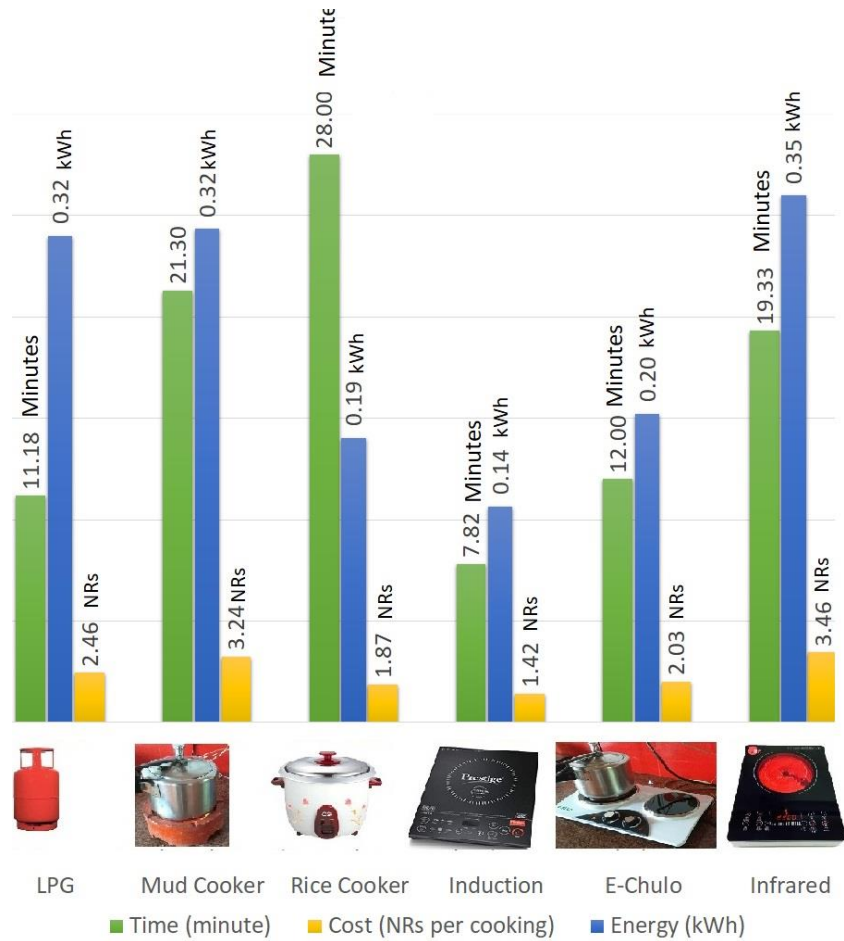


Figure 3: Time, energy and cost comparison of rice cooking using different cooker

Table 1: Advantages and Disadvantages of different Cookers (in Nepalese Context)

S/N	Type of Cooker	Advantages	Disadvantages	Remarks
1	LPG Cooking	<ul style="list-style-type: none"> <li>• Simple in Operation</li> <li>• Convenient to use</li> <li>• Fully user control</li> <li>• Already well known and most well familiar technology</li> </ul>	<ul style="list-style-type: none"> <li>• Fuel Needs to be imported</li> <li>• Advance investment in LPG cylinders</li> <li>• Increases indoor pollution by two to five times compared to outdoor air quality</li> </ul>	<ul style="list-style-type: none"> <li>• Fossil Fuel based/source of GHGs emissions</li> </ul>
2	Mud Coil Heater	<ul style="list-style-type: none"> <li>• Very Cheap</li> <li>• Simple Operation</li> <li>• Locally manufactured</li> </ul>	<ul style="list-style-type: none"> <li>• Safety Issue</li> <li>• Frequent breakdown of coil</li> <li>• Heat loss</li> <li>• Consumes more electrical energy</li> </ul>	<ul style="list-style-type: none"> <li>• Needs robust house wiring and utility infrastructure for multiple use</li> </ul>
3	Rice Cooker	<ul style="list-style-type: none"> <li>• Very simple to use, widely available and cheap</li> </ul>	<ul style="list-style-type: none"> <li>• Less efficient and more costly for cooking</li> <li>• Takes longer time to cook</li> </ul>	<ul style="list-style-type: none"> <li>• Applicable only for rice cooking</li> </ul>
4	Induction Cooker	<ul style="list-style-type: none"> <li>• Most efficient and least cost for cooking</li> <li>• Highly safe to use, decreases risk of burns and accidental fires unlike LPG</li> </ul>	<ul style="list-style-type: none"> <li>• Complicate operation in some cases</li> <li>• Needs special utensils</li> <li>• Power interruption, needs LPG as backup</li> </ul>	<ul style="list-style-type: none"> <li>• Needs robust house wiring and utility infrastructure</li> <li>• Quality and Standards of a Cooker is a major concern</li> </ul>
5	Infrared Cooker (Dolphn)	<ul style="list-style-type: none"> <li>• Can use any type of utensils unlike Induction Cooker</li> <li>• Can warm surrounding spaces in some extent</li> </ul>	<ul style="list-style-type: none"> <li>• Metallic part gets heated, loss of some energy</li> <li>• Consumes more energy than Induction cooker</li> </ul>	<ul style="list-style-type: none"> <li>• Needs robust house wiring and utility infrastructure</li> <li>• PF=0.7</li> </ul>
6	Two burner Induction/ Infrared Cooker	<ul style="list-style-type: none"> <li>• Saves cooking time</li> <li>• Phycological impact of visible smokeless burning fire</li> </ul>	<ul style="list-style-type: none"> <li>• May surge peak power demand during morning and evening</li> <li>• Needs higher capacity fuse/meter in house and hence cause higher tariff</li> </ul>	<ul style="list-style-type: none"> <li>• Needs robust house wiring and utility infrastructure</li> <li>• PF=0.99</li> </ul>

## 5. How Many Induction Cookers Imported so far?

As per Trade Promotion Centre 425,000 Induction Cookers have been imported to Nepal as quoted by the secretary, MoEWRI, as mentioned in Karobar Newspaper dated 2076/10/14.

## 6. Environmental Benefits (source: ISHRAE, Dec 12, 2019, Kathmandu Conference, [ishrae.in/Nepal](http://ishrae.in/Nepal))

- LPG emits 81% of CO<sub>2</sub> per kWh produced by oil, 70% of coal, 8.8 million people are affected by Indoor Pollution world wide
- People spend 90% of the time inside the house/indoors
- 92% of the people worldwide do not breath quality air as per WHO

## 7. Actions to be taken:

What is needed for making Induction and Infrared based cooking a success?

Supply Side Management	Demand Side Management
<ul style="list-style-type: none"> <li>• Supply of QUALITY Electricity (220 V AC, 50 Hz even at a distance of say 5 km from distribution transformer)</li> <li>• SUFFICIENT electricity (is size of distribution transformer adequate?)</li> <li>• REGULAR supply of electricity</li> <li>• DEPENDABLE SUPPLY</li> <li>• AFFORDABLE price of electricity (should be less than the cost of LPG) (reduce electricity cost by 10% now to motivate people)</li> <li>• Appropriate FUSING of consumer energy meter (at least 15 A)</li> </ul>	<ul style="list-style-type: none"> <li>• Provide appropriate size of the Induction /Infrared cooker (2 pot or 3 pot with variable power 500 W, 1000 W, 1500 W)</li> <li>• Manufacture ICs/Infrds based on 12 V /24 V/48 V DC (specially for applications in areas without NEA grid (IOE M.Sc. Project)</li> <li>• More awareness in using /Infrds among the potential users</li> <li>• Provide Quality ICs/Infrds for affordable prices (may be with instalment payment basis)</li> <li>• Easily available quality repair services for ICs/Infrds (insurance against nominal monthly payment)</li> </ul>

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